CLAIMS

This is a complete and current listing of the current claims marked with status identifiers in parentheses.

1. (Cancelled)

2. (Previously Presented) A color display device that determines a relationship between three color components of an input color image signal in terms of gradation levels of the three color components of an input color image signal, and that carries out a different calculation for each input color image signal depending on which of six patterns of the relationship that the input color image signal belongs to, the calculation being performed for each of the three color components excluding a component with a relatively smallest gradation level, using variables varying depending on the relationship among the respective gradation levels of the three color components, wherein the gradation level of the color component with the relatively smallest gradation level remains unchanged before and after the calculation, and wherein:

the input color image signal is converted into an output color image signal with the at least three color components respectively having gradation levels of r', g' and b', which are given by:

$r'=r+ro+yo+mo$,

$g'=g+go+yo+co$,

$b'=b+bo+mo+co$,

where r, g and b are values obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1; and

in a case [1] where $r \geq g \geq b$:

$ro=Krg(r-g)^{Nr}$,

$yo=Kyg(g-b)^{Ny}$,

$go=bo=mo=co=0$,

in a case [2] where $r \geq b > g$:

$ro=Krb(r-b)^{Nr}$,

$mo=Kmb(b-g)^{Nm}$,

go=bo=yo=co=0,

in a case [3] where b>r≥g:

$bo=Kbr(b-r)^{Nb}$,

$mo=Kmr(r-g)^{Nm}$,

ro=go=yo=co=0,

in a case [4] where b>g>r:

$bo=Kbg(b-g)^{Nb}$,

$co=Kcg(g-r)^{Nc}$,

ro=go=yo=mo=0,

in a case [5] where g≥b>r:

$go=Kgb(g-b)^{Ng}$,

$co=Kcb(b-r)^{Nc}$,

ro=bo=yo=mo=0,

in a case [6] where g>r≥b:

$go=Kgr(g-r)^{Ng}$,

$yo=Kyr(r-b)^{Ny}$,

ro=bo=mo=co=0,

in which Krg, Krb, Kbr, Kbg, Kgb, Kgr, Kyg, Kyr, Kmb, Kmr, Kcg and Kcb are variables which change depending on values of r, g and b; and Nr, Ng, Nb, Ny, Nm and Nc are constants not less than 0.

3. (Cancelled)

4. (Cancelled)

5. (Withdrawn – Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

$Krg=Cr\cdot frg(r,b)$, $Krb=Cr\cdot frb(r,g)$,

$Kgr=Cg\cdot fgr(g,b)$, $Kgb=Cg\cdot fgb(g,r)$,

$Kbr=Cb\cdot fbr(b,g)$, $Kbg=Cb\cdot fbg(b,r)$,

$Kyg=Cy\cdot fyg(r,b)$, $Kmb=Cm\cdot fmb(r,g)$,

Kmr=Cm·fmr (b,g), Kcg=Cc·fcg (b,r),

Kcb=Cc·fcb (g,r), Kyr=Cy·fyr (g,b),

where Cr, Cb, Cg, Cy, Cm and Cc are constants; frg, frb, fgr, fgb, fbr, fbg, fyg, fmb, fmr, fcg, fcb and fyr are functions which respectively change depending on values of r, g and b in corresponding brackets; and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

6. (Withdrawn – Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

Krg=Cr·far (r)·fag (b), Krb=Cr·far (r)·fab (g),

Kgr=Cg·fag (g)·far (b), Kgb=Cg·fag (g)·fab (r),

Kbr=Cb·fab (b)·far (g), Kbg=Cb·fab (b)·fag (r),

Kyg=Cy·far (r)·fab (b), Kmb=Cm·far (r)·fag (g),

Kmr=Cm·fab (b)·fag (g), Kcg=Cc·fab (b)·far (r),

Kcb=Cc·fag (g)·fa r(r), Kyr=Cy·fag (g)·fab (b),

where Cr, Cb, Cg, Cy, Cm and Cc are constants; far, fab and fag are functions which respectively change depending on values of r, g and b in corresponding brackets; and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

7. (Withdrawn) The color display device as set forth in claim 6, wherein:

the functions far(r), fab(b) and fag(g) are continuous functions which give 0 when the r, g and b ($0 \le r,g,b \le 1$) are 0 or 1.

8. (Withdrawn- Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

Krg=Cr·αr·αb, Krb=Cr·αr·αg,

Kgr=Cg·αg·αb, Kgb=Cg·αg·αr,

$Kbr=Cb\cdot\alpha b\cdot\alpha g$, $Kbg=Cb\cdot\alpha b\cdot\alpha r$,

$Kyg=Cy\cdot\alpha r\cdot\alpha b$, $Kmb=Cm\cdot\alpha r\cdot\alpha g$,

$Kmr=Cm\cdot\alpha b\cdot\alpha g$, $Kcg=Cc\cdot\alpha b\cdot\alpha r$,

$Kcb=Cc\cdot\alpha g\cdot\alpha r$, $Kyr=Cy\cdot\alpha g\cdot\alpha b$,

$\alpha r=f_0\times r^k$ $(0\le r<Mr)$,

$\alpha r=f_1\times(1-r)^k$ $(Mr\le r\le 1)$,

$\alpha g=g_0\times gk$ $(0\le g<Mg)$,

$\alpha g=g_1\times(1-g)^k$ $(Mg\le g\le 1)$,

$\alpha b=h_0\times b^k$ $(0\le b<Mb)$,

$\alpha b=h_1\times(1-b)^k$ $(Mb\le b\le 1)$,

where f_0, f_1, g_0, g_1, h_0, h_1, Mr, Mg, Mb and k are constants; Cr, Cb, Cg, Cy, Cm and Cc are constants, and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

9. (Withdrawn– Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

$Krg=Cr\cdot\alpha r\cdot\alpha b$, $Krb=Cr\cdot\alpha r\cdot\alpha g$,

$Kgr=Cg\cdot\alpha g\cdot\alpha b$, $Kgb=Cg\cdot\alpha g\cdot\alpha r$,

$Kbr=Cb\cdot\alpha b\cdot\alpha g$, $Kbg=Cb\cdot\alpha b\cdot\alpha r$,

$Kyg=Cy\cdot\alpha r\cdot\alpha b$, $Kmb=Cm\cdot\alpha r\cdot\alpha g$,

$Kmr=Cm\cdot\alpha b\cdot\alpha g$, $Kcg=Cc\cdot\alpha b\cdot\alpha r$,

$Kcb=Cc\cdot\alpha g\cdot\alpha r$, $Kyr=Cy\cdot\alpha g\cdot\alpha b$,

$\alpha r=2\times r$ $(0\le r<0.5)$,

$\alpha r=2\times(1-r)$ $(0.5\le r\le 1)$,

$\alpha g=2\times g$ $(0\le g<0.5)$,

$\alpha g=2\times(1-g)$ $(0.5\le g\le 1)$,

$\alpha b=2\times b$ $(0\le b<0.5)$,

$\alpha b=2\times(1-b)$ $(0.5\le b\le 1)$,

where Cr, Cb, Cg, Cy, Cm and Cc are constants, and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

10. (Withdrawn– Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

Krg=Cr·fmax (r)·fmin (b), Krb=Cr·fmax (r)·fmin (g),

Kgr=Cg·fmax (g)·fmin (b), Kgb=Cg·fmax (g)·fmin (r),

Kbr=Cb·fmax (b)·fmin (g), Kbg=Cb·fmax (b)·fmin (r),

Kyg=Cy·fmax (r)·fmin (b), Kmb=Cm·fmax (r)·fmin (g),

Kmr=Cm·fmax (b)·fmin (g), Kcg=Cc·fmax (b)·fmin (r),

Kcb=Cc·fmax (g)·fmin (r), Kyr=Cy·fmax (g)·fmin (b),

where Cr, Cb, Cg, Cy, Cm and Cc are constants; fmax, and fmin are functions which respectively change depending on values of r, g and b in corresponding brackets; and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

11. (Withdrawn) The color display device as set forth in claim 10, wherein:

the function fmax is a continuous function which gives 0 when the r, g and b ($0 \le r,g,b \le 1$) are 1; and the function fmin is continuous function which gives 0 when the r, g and b ($0 \le r,g,b \le 1$) are 0.

12. (Withdrawn– Previously Presented) The color display device as set forth in claim 2, wherein:

the variables are expressed as:

Krg=Cr·Sr·Tb, Krb=Cr·Sr·Tg,

Kgr=Cg·Sg·Tb, Kgb=Cg·Sg·Tr,

Kbr=Cb·Sb·Tg, Kbg=Cb·Sb·Tr,

Kyg=Cy·Sr·Tb, Kmb=Cm·Sr·Tg,

$Kmr=Cm\cdot Sb\cdot Tg$, $Kcg=Cc\cdot Sb\cdot Tr$,

$Kcb=Cc\cdot Sg\cdot Tr$, $Kyr=Cy\cdot Sg\cdot Tb$,

$Tr=r^k$,

$Sr=(1-r)^k$,

$Tg=g^k$,

$Sg=(1-g)^k$,

$Tb=b^k$,

$Sb=(1-b)^k$,

where Cr, Cb, Cg, Cy, Cm, Cc and k are constants, and the r, g and b are obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1.

13. (Withdrawn) The color display device as set forth in claim 12, wherein:

the constant k is 1.

14. (Withdrawn) The color display device as set forth in claim 5, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

15. (Currently Amended) The color display device as set forth in claim 42, wherein:

the variables Nr and Ny are not less than ~~2~~1.

16. (Currently Amended) The color display device as set forth in claim 42, wherein:

the variables Ng, Nb, Nm and Nc are not more than ~~2~~1.

17. – 20. (Cancelled)

21. (Currently Amended) A color display device, comprising:

a color processor to determine a relationship between three color components of an input color image signal in terms of gradation levels of the three color components of an input color image signal, and to process the input color image signal by carrying out a different calculation for each input color image signal depending on which of six patterns of the determined relationship that the input color image signal belongs to, the calculation being performed for each of the three color components excluding a component with a relatively smallest gradation level, using variables varying depending on the relationship among the respective gradation levels of the three color components, wherein the gradation level of the color component with the relatively smallest gradation level remains unchanged before and after the calculation; and

a color display panel to display the processed color image signal~~The color display device as set forth in claim 139~~, wherein:

the input color image signal is converted into an output color image signal with the three color components respectively having gradation levels of r', g' and b', which are given by:

$$\begin{pmatrix} r' \\ g' \\ b' \end{pmatrix} = \begin{pmatrix} r \\ g \\ b \end{pmatrix} + A_{36} \begin{pmatrix} ro \\ go \\ bo \\ yo \\ mo \\ co \end{pmatrix}$$

where r, g and b are values obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1; and A_{36} expresses square matrix of 3x6; and

in a case [1] where r≥g≥b:

$ro=Krg(fzr(r)-fzg(g))^{Nr}$,

$yo=Kyg(fzg(g)-fzb(b))^{Ny}$,

go=bo=mo=co=0,

in a case [2] where r≥b>g:

$ro=Krb(fzr(r)-fzb(b))^{Nr}$,

$mo=Kmb(fzb(b)-fzg(g))^{Nm}$,

go=bo=yo=co=0,

in a case [3] where b>r≥g:

$bo=Kbr(fzb(b)-fzr(r))^{Nb}$,

$mo=Kmr(fzr(r)-fzg(g))^{Nm}$,

ro=go=yo=co=0,

in a case [4] where b>g>r:

$bo=Kbg(fzb(b)-fzg(g))^{Nb}$,

$co=Kcg(fzg(g)-fzr(r))^{Nc}$,

ro=go=yo=mo=0,

in a case [5] where g≥b>r:

$go=Kgb(fzg(g)-fzb(b))^{Ng}$,

$co=Kcb(fzb(b)-fzr(r))^{Nc}$,

ro=bo=yo=mo=0,

in a case [6] where g>r≥b:

$go=Kgr(fzg(g)-fzr(r))^{Ng}$,

$yo=Kyr(fzr(r)-fzb(b))^{Ny}$,

ro=bo=mo=co=0,

in which Krg, Krb, Kbr, Kbg, Kgb, Kgr, Kyg, Kyr, Kmb, Kmr, Kcg and Kcb are variables which change depending on values of r, g and b, Nr, Ng, Nb, Ny, Nm and Nc are constants not less than 0, and fzr, fzg, fzb are functions which respectively change depending on values of r, g and b in corresponding brackets.

22. (Original) The color display device as set forth in claim 21, wherein:

the functions fzr, fzg, fzb convert input values identical with each other into output values different from each other.

23. (Original) The color display device as set forth in claim 21, wherein:

the functions fzr, fzg, fzb satisfy $fzr=r^{2.2}$, $fzg=g^{2.2}$ and $fzb=b^{2.2}$.

24. (Original) The color display device as set forth in claim 21, wherein:

the functions fzr, fzg, fzb satisfy $fzr=r^2$, $fzg=g^2$ and $fzb=b^2$.

25. – 30. (Cancelled)

31. (Currently Amended) A color display device, comprising:

a color processor to determine a relationship between three color components of an input color image signal in terms of gradation levels of the three color components of an input color image signal, and to process the input color image signal by carrying out a different calculation for each input color image signal depending on which of six patterns of the determined relationship that the input color image signal belongs to, the calculation being performed for each of the three color components excluding a component with a relatively smallest gradation level, using variables varying depending on the relationship among the respective gradation levels of the three color components, wherein the gradation level of the color component with the relatively smallest gradation level remains unchanged before and after the calculation; and

a color display panel to display the processed color image signal~~The color display device as set forth in claim 139~~, wherein:

the input color image signal is converted into an output color image signal with the three color components respectively having gradation levels of r', g' and b', which are given by:

r'=r+ro+yo+mo

g'=g+go+yo+co

b'=b+bo+mo+co

where r, g and b are values obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1; and,

ro=Cr·min (rg, rb),

go=Cg·min (gr, gb),

bo=Cb·min (br, bg),

yo=Cy·min (rb, gb),

mo=Cm·min (rg, bg),

co=Cc·min (gr, br),

in which min () is a function for giving a smallest value in a corresponding bracket; and Cr, Cg, Cb, Cy, Cm and Cc are constants,

on condition that:

rg=r-g,

rb=r-b,

gr=g-r,

gb=g-b,

br=b-r,

bg=b-g,

in which each of rg, rb, gr, gb, br and bg are modified to 0 when they are minus values.

32. (Currently Amended) A color display device, comprising:

a color processor to determine a relationship between three color components of an input color image signal in terms of gradation levels of the three color components of an input color image signal, and to process the input color image signal by carrying out a different calculation for each input color image signal depending on which of six patterns of the determined relationship that the input color image signal belongs to, the calculation being performed for each of the three color components excluding a component with a relatively smallest gradation level, using variables varying depending on the relationship among the respective gradation levels of the three color components, wherein the gradation level of the color component with the relatively smallest gradation level remains unchanged before and after the calculation; and

a color display panel to display the processed color image signal~~The color display device as set forth in claim 139~~, wherein:

the input color image signal is converted into an output color image signal with the three color components respectively having gradation levels of r', g' and b', which are given by:

r'=r+ro+yo+mo

g'=g+go+yo+co

b'=b+bo+mo+co

where r, g and b are values obtained by dividing original gradation levels of the three color components of the input color image signal by a maximum gradation value N-1; and

ro=Krg·rg where rg<rb,

ro=Krb·rb where rg>rb,

go=Kgr·gr where gr<gb,

go=Kgb·gb where gr>gb,

bo=Kbr·br where br<bg,

bo=Kbg·bg where br>bg,

yo=Kyr·rb where rb<gb,

yo=Kyg·gb where rb>gb,

mo=Kmr·rg where rg<bg,

mo=Kmb·bg where rg>bg,

co=Kcg·gr where gr<br,

co=Kcb·br where gr>br,

in which Krg, Krb, Kbr, Kbg, Kgb, Kgr, Kyg, Kyr, Kmb, Kmr, Kcg and Kcb are variables which change depending on values of r, g and b,

on condition that:

rg=r-g,

rb=r-b,

gr=g-r,

gb=g-b,

br=b-r,

bg=b-g,

in which each of rg, rb, gr, gb, br and bg are modified to 0 when they are minus values.

33. – 59. (Cancelled)

60. (Previously Presented) The color display device as set forth in claim 2, further comprising:

detector to detect environmental changes; and

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, according to a result of detection by the detector.

61. (Original) The color display device as set forth in claim 60, wherein:

the detector detects light intensity of outside of the color display device.

62. (Previously Presented) The color display device as set forth in claim 2, further comprising:

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, depending on whether a backlight of a semi-transmission liquid crystal panel is on or off.

63. – 76. (Cancelled)

77. (Withdrawn) The color display device as set forth in claim 6, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

78. (Withdrawn) The color display device as set forth in claim 8, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

79. (Withdrawn) The color display device as set forth in claim 9, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

80. (Withdrawn) The color display device as set forth in claim 10, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

81. (Withdrawn) The color display device as set forth in claim 12, wherein:

the Cr, Cb, Cg, Cy, Cm and Cc are constants expressed as 1/(integer power of 2).

82. – 96. (Cancelled)

97. (Withdrawn- Previously Presented) The color display device as set forth in claim 21, further comprising:

detector to detect environmental changes; and

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, according to a result of detection by the detector.

98. – 101. (Cancelled)

102. (Withdrawn- Previously Presented) The color display device as set forth in claim 31, further comprising:

a detector to detect environmental changes; and

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, according to a result of detection by the detector.

103. - 104. (Cancelled)

105. (Withdrawn- Previously Presented) The color display device as set forth in claim 21, further comprising:

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, depending on whether a backlight of a semi-transmission liquid crystal panel is on or off.

106. – 109. (Cancelled)

110. (Withdrawn- Previously Presented) The color display device as set forth in claim 31, further comprising:

color converter to control at least one of the coefficients Nr, Ng, Nb, Ny, Nm, Nc, Cr, Cg, Cb, Cy, Cm, Cc, Pr, Py and a factor of A_{36}, and the functions fzr, fzg, fzb, fw, fnr, fng, fnb, fny, fnm and fnc, depending on whether a backlight of a semi-transmission liquid crystal panel is on or off.

111. - 131. (Cancelled)

132. (Original) The color display device as set forth in claim 2, wherein:

the relatively greatest component in gradation level among the three components of RGB is compensated by using both the compensation value of the relatively greatest component and the compensation value of the complementary color of the relatively greatest component and the second relatively greatest component, and the second relatively greatest component in gradation level among the RGB components is compensated by using the compensation value of complementary color of the relatively greatest component and the second relatively greatest component.

133. - 149. (Cancelled)